Title: A City Under Construction

Brief Overview:

Students will construct models for a city that is in need of new buildings. These activities will integrate patterns and their connection to real-life situations in the renovation of the city shopping center, sports complex, bridges, and single family homes.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended problems which are solved in a cooperative atmosphere.

- **Mathematics as Communication**
  Students will communicate mathematically. They will read, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will connect mathematics topics within the discipline and with other disciplines.

- **Concepts of Whole Number Operations**
  Students will describe characteristics of numbers such as odd and even and will apply estimation in problem solving.

- **Statistics and Probability**
  Students will observe patterns and make predictions, collect, organize, and display data on a chart or table.

- **Patterns and Relationships**
  Students will recognize patterns, identify regularities, classify and organize information, identify regularities in shapes, designs and number sets, create, explain, and extend patterns.

Grade/Level:

Grade 3

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Addition and subtraction of whole numbers
- Counting by two
- Distinguishing colors and shapes.
- Basic multiplication
- Distinguishing odds and evens

Objectives:

Students will:

- work cooperatively in groups.
- identify patterns.
- apply number relationships.
- communicate mathematical terms and restate the problem.
- speculate, interpret and explore the problem.
- make predictions.
- collect, organize, and record data.
- evaluate the effectiveness of a solution.

Materials/Resources/Printed Materials:

- pattern blocks
- Cuisenaire Rods
- overhead projector
- transparencies
- write-off markers
- math chart or math word wall
- student resource sheets
- teacher prompts
- toothpicks
- construction paper
- sentence strip

Development/Procedures:

A developer was asked to visit a community to make recommendations as to how to make the area more beautiful. His recommendations included tearing down houses and replacing them with more modern houses. Recommendations also included building bridges to connect this neighborhood with other neighborhoods within the city.

Activity 1:

Students identify and copy patterns demonstrated by the teacher and understand vocabulary: pattern, copy, continue, and term.

A.
Teacher shows sentence strip of two different types of houses (see attachment for prompt #1, A B A B A B). She asks, "What can you tell me about these houses?" Students respond appropriately as houses are shaped differently. She asks, "What can you tell me about the way these houses are arranged?" Ask students to state a rule.

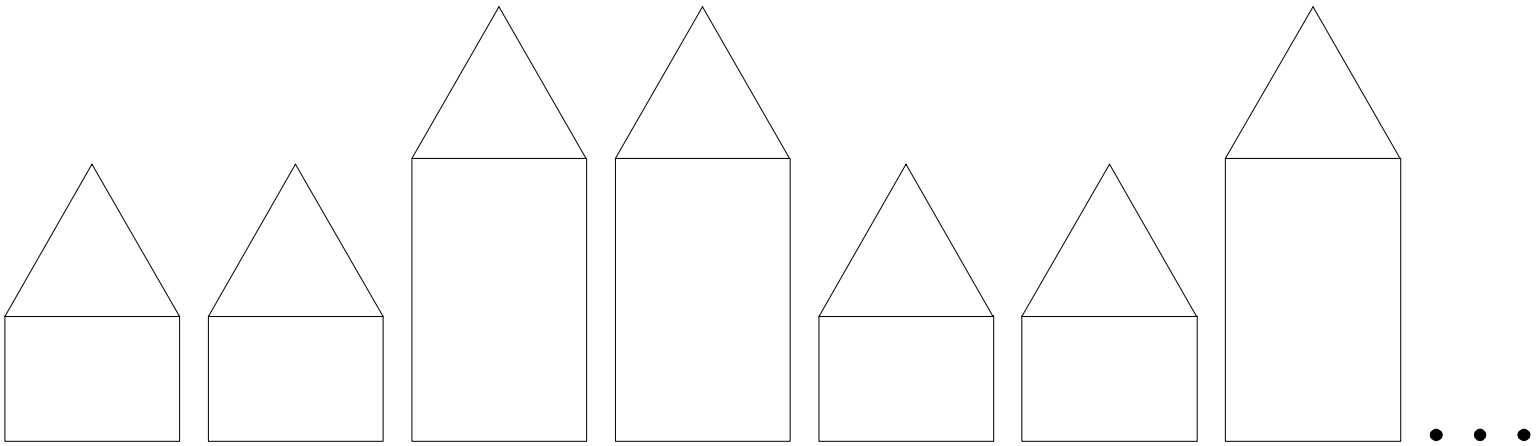
B.
The teacher then shows a different pattern of the same houses (see attachment 2. AA BB AA BB AA BB. Repeat questions as for prompt 1). Ask students to state a rule.

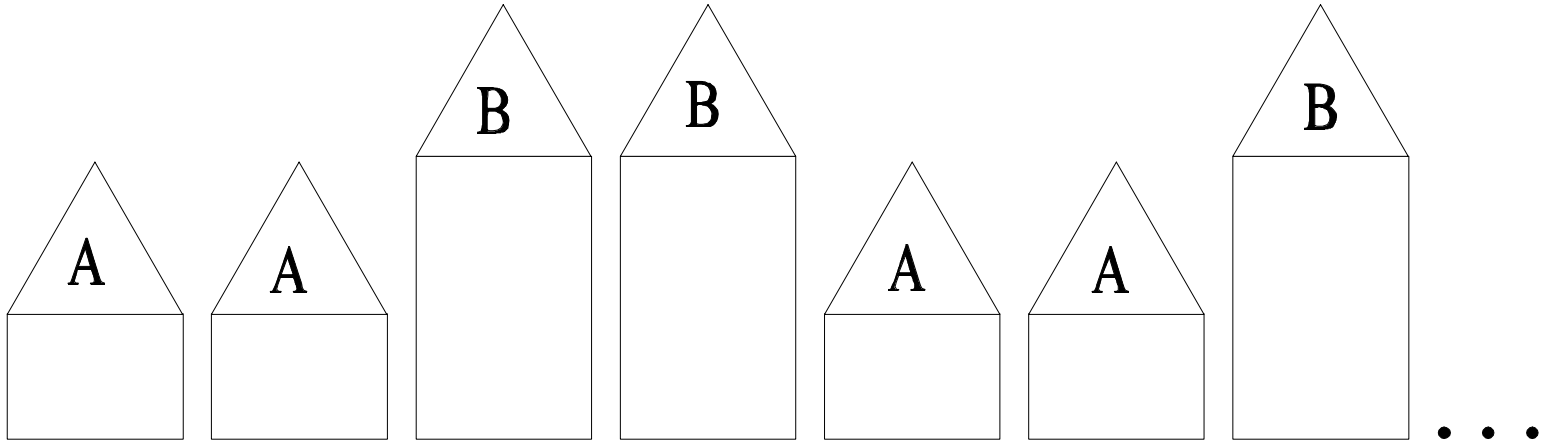
C.
Students are then asked to work in groups of two to copy the house pattern #1 using pattern blocks or other manipulatives.

D.
Students work cooperatively as they continue the pattern at least two more terms. Students describe their pattern.

E.
Students will work cooperatively in groups to create their own pattern of houses using three letters. They describe their construction and then continue two more terms.

F.
Students make journal entry describing the patterning activities being sure to include the A B form. using mathematics vocabulary from "Word Wall."

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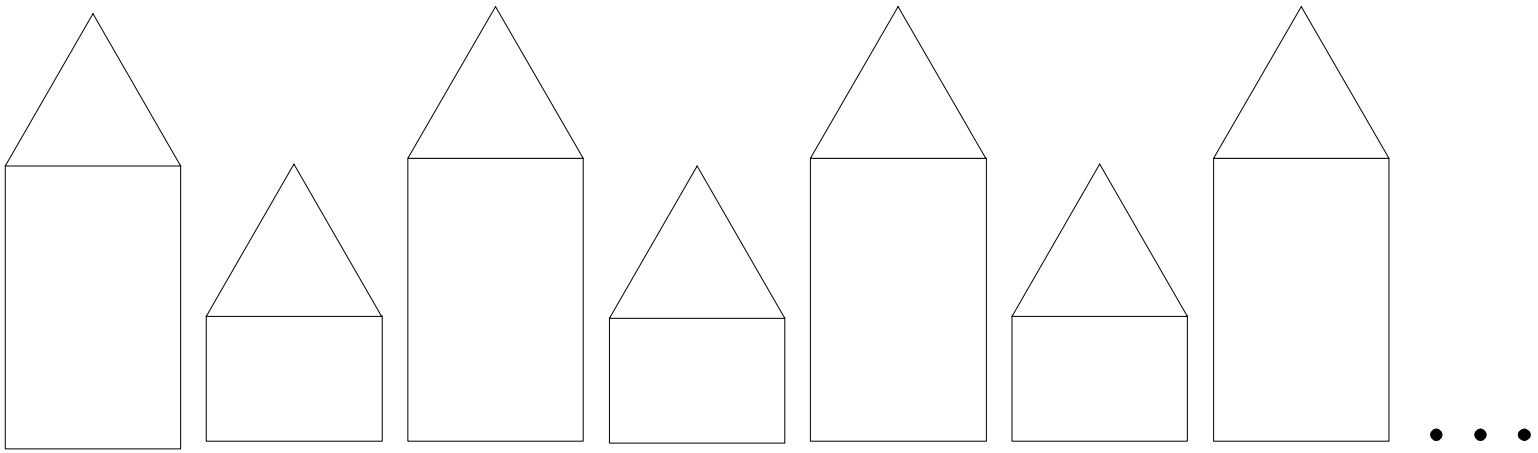

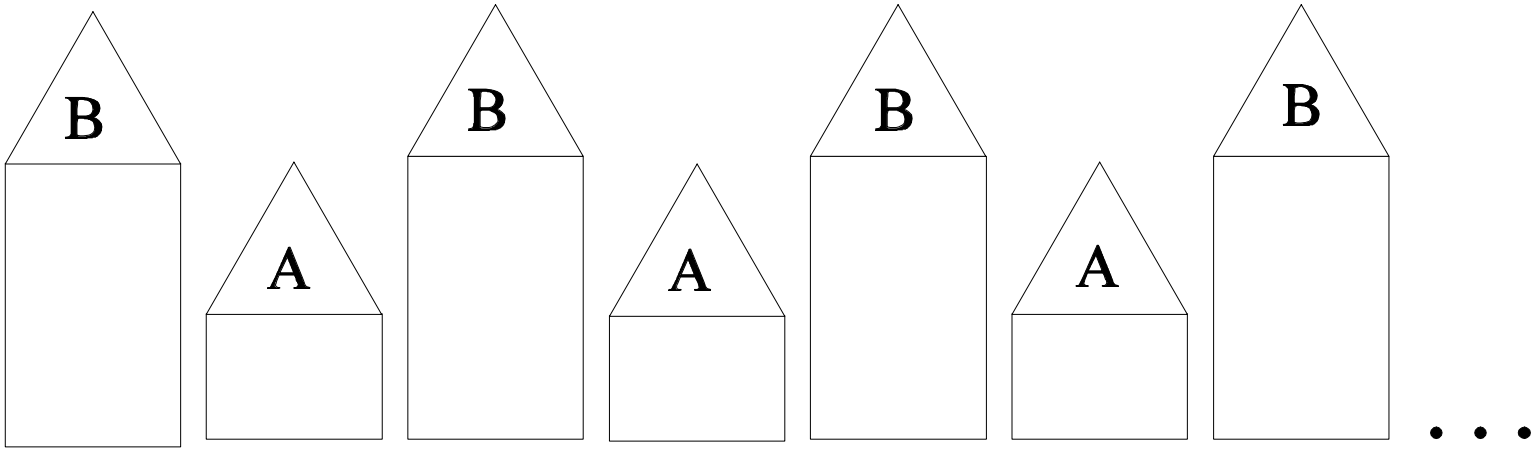
B
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Activity 2

Students will work cooperatively to copy a pattern, reason mathematically to solve a problem and generate and understand tables while constructing houses made of toothpicks.

A.
Using the an overhead projector, the teacher shows students how toothpicks are used to construct one house. Discuss how many toothpicks were used and how the toothpicks were arranged.

B.
Students will copy the pattern.

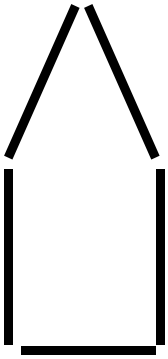
C.
Teacher asks students how many toothpicks they think will be needed to construct two houses. Students respond appropriately.

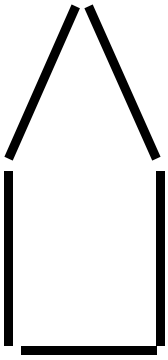
D.
Teacher begins table on chalkboard or overhead.

E.
Teacher asks "How many toothpicks will be needed to construct five houses?" Students work cooperatively to determine the number of toothpicks needed from data on the table. Students will state a rule. See activity sheet 2.

Student Resource Sheet #1

Use five toothpicks to construct one house.





Use ten toothpicks to construct two houses.

How many toothpicks will it take to construct six houses?

House	Toothpicks
1st	5
2nd	10
3rd	15
4th	___
5th	___
6th	___

Explain your answer.

Activity 3

Students will apply odd-even concept to create house number patterns for the new community.

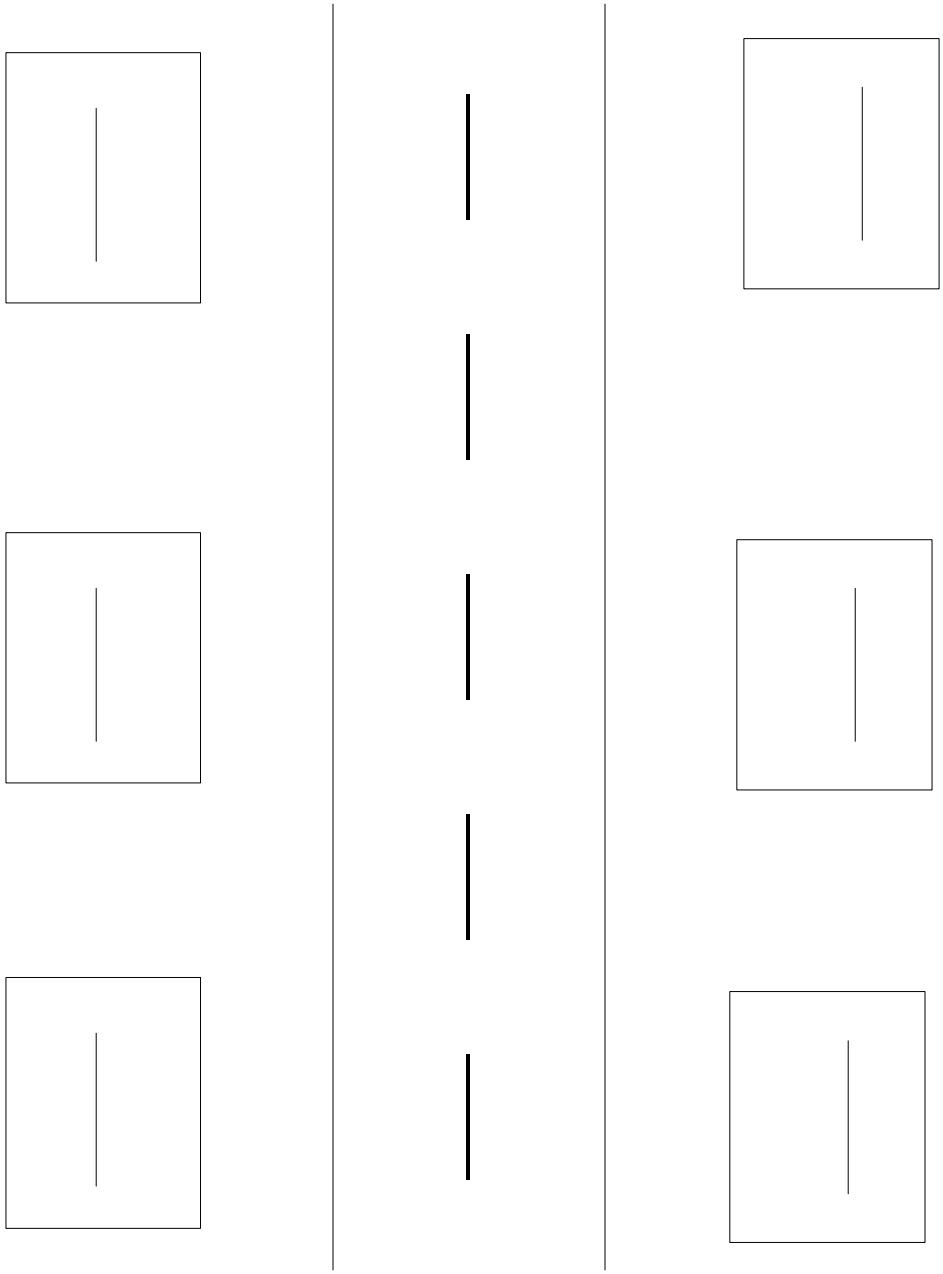
A. Initiate discussion about how houses are identified on the same street. Students will respond that every house or apartment building has a different number. Students should also note that the addresses on one side of the street are odd numbers and addresses on the opposite side are even.
Show student resource #2. Students are asked to number these houses as they would be numbered in a real community. Discuss blocks of numbers.

B. Give students construction paper, crayons or markers.
Have students create a pattern for addresses.
Assign groups of students series of numbers (example: 100 block, 200 block, 300 block etc.). Survey student's work.
Volunteers share the houses and addresses that they constructed.
Encourage students to use appropriate math vocabulary as patterns are described.
State a rule that generates the pattern in the sequence.
Have students number houses on map creating their own address. Students will explain their own pattern.

C. Distribute Activity Sheet 3.
Explain that this is a sample of a street in the new community.
Explain that odd numbers should be placed on one side of the street and even numbers on the other.

Student Activity Sheet 3

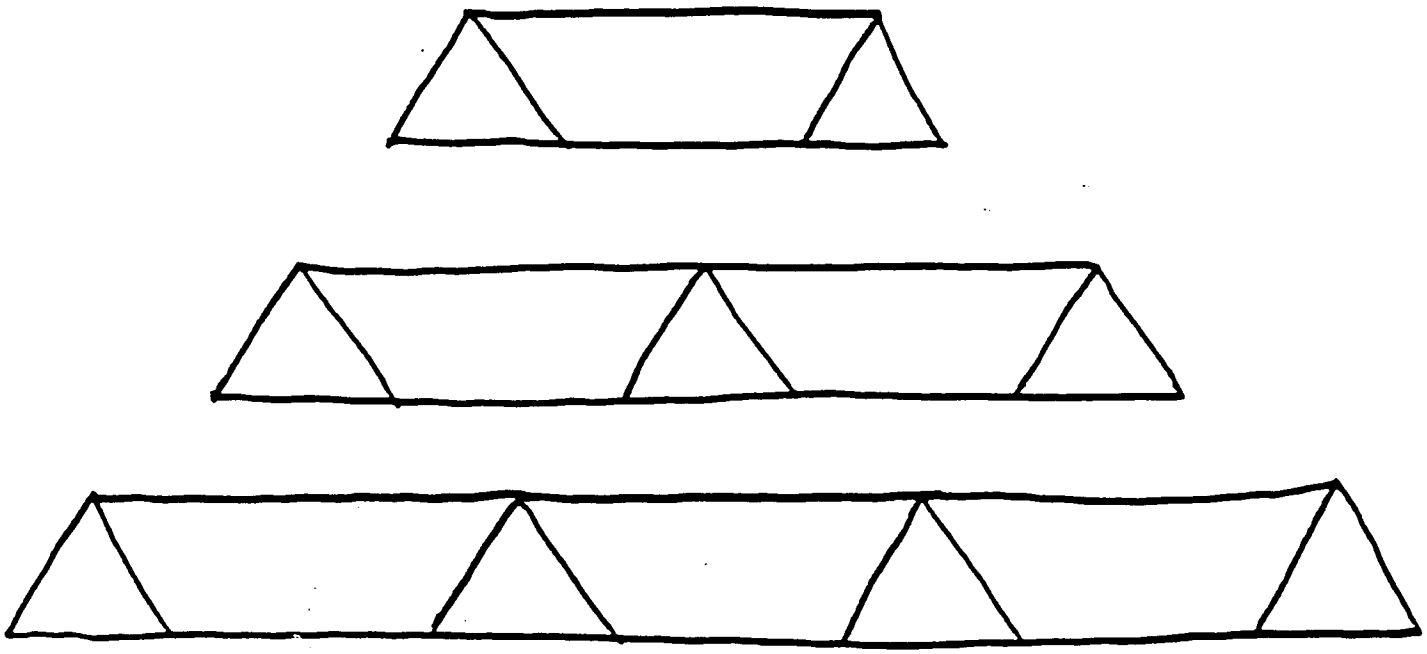
Directions: Create address patterns for these houses on Elm Street.



Activity 4

A.
Students will identify a pattern, state a rule, predict the number of blocks needed for building a model of a bridge.

Teacher instructs the students to copy the bridge like the ones shown. Teacher states that the trapezoid block is used as the bridge. The bridge takes two green triangles that will be used as supports for the bridge. Use the information to complete the table.



Bridge	Supports
1	2
2	3
3	4
—	—
—	—
—	—
—	—
—	—
10	—

Explain the rule for your answer.

Activity 5

Students will use input output to record information on a table, state a rule.

The developers for the new mall are preparing for the first department store. They know that seven pounds of cement is needed to create one floor. The department will need six floors. Using input output, determine the data needed to complete the table.

A.

. The teacher will instruct students to work in pairs.
. Teacher instructs students to pour seven pounds of cement into the mixer.
. One student enters in the calculator +7.
. The other student repeatedly enters { = }.
. One of the two students will record the results on the . table.

Rule: ____ x ____ + 1 = ___
Bags x 9 + 1

Number of pounds of cement per floor.

Number of floors 1 2 3 4 5 6 7 8 9

_____

Number of pounds 10 19 28 of cement

Student Journal Page

Performance Assessment:

Student performance of the stated objectives will be scored using rubrics. Additionally, students will demonstrate the use of appropriate math vocabulary as related to patterns. Journal entries will also be scored used.

Rubric For Activity 1

3 Points

Identified the pattern core.
Repeated the core at least once.
Used math vocabulary.

2 Points

Identified the pattern core.
Repeated the core once.

1 Point

Identify the pattern core but did not repeat it.

0 Points

Did not identify the pattern core.
Did not use the math term.

Rubric for Activity 2

3 Points

Uses math language.
Explains thinking with evidence.
Uses a table to help develop the rule.
States reasons why pattern is correct.
Illustrates work.

2 Points

Uses math language.
Uses a table to develop rule.
Illustrates work.

1 Point

Illustrates work.
Uses math language.

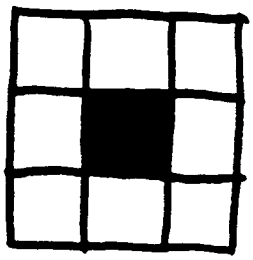
0 Points

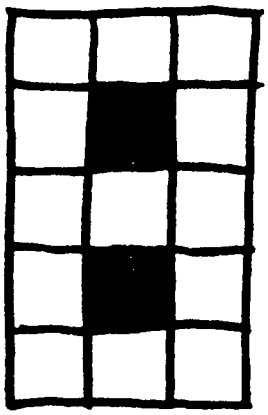
Uses math language.

Assessment Task

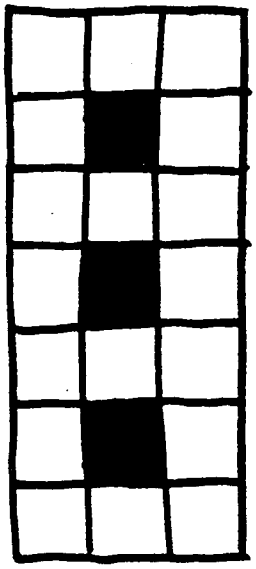
A group of developers have been asked by the mayor to build a shopping center in the city. Read the following questions about each department store. Use the data that is given to complete this activity.

A department store with 1 orange window takes 8 blue cubes.





A department store with 2 orange windows takes 13 blue cubes.



A department store with 3 orange windows takes 18 blue cubes.

How many blue cubes will you need for a department store with 10 orange windows?

How did you come up with your answer? Explain.

Rubric Scoring Tool For Assessment

3 Points

The student generates a table.
Explains and justifies their reasoning by using appropriate mathematical language.
States a rule.

2 Points

The student is able to reason logically.
States a rule.

1 Points

The student is able to reason logically.

0 Point

The student is not able to justify their answer in any way.

Extension/Follow Up:

Students use blocks and other manipulatives to construct model of ideal community including buildings discussed in unit.
Take a field trip to The National Building Museum in downtown Washington, D.C. to look for patterns.
Work in groups to construct mural of city identifying and discussing patterns.
Guest speaker (architect) visits to share patterns in building construction.

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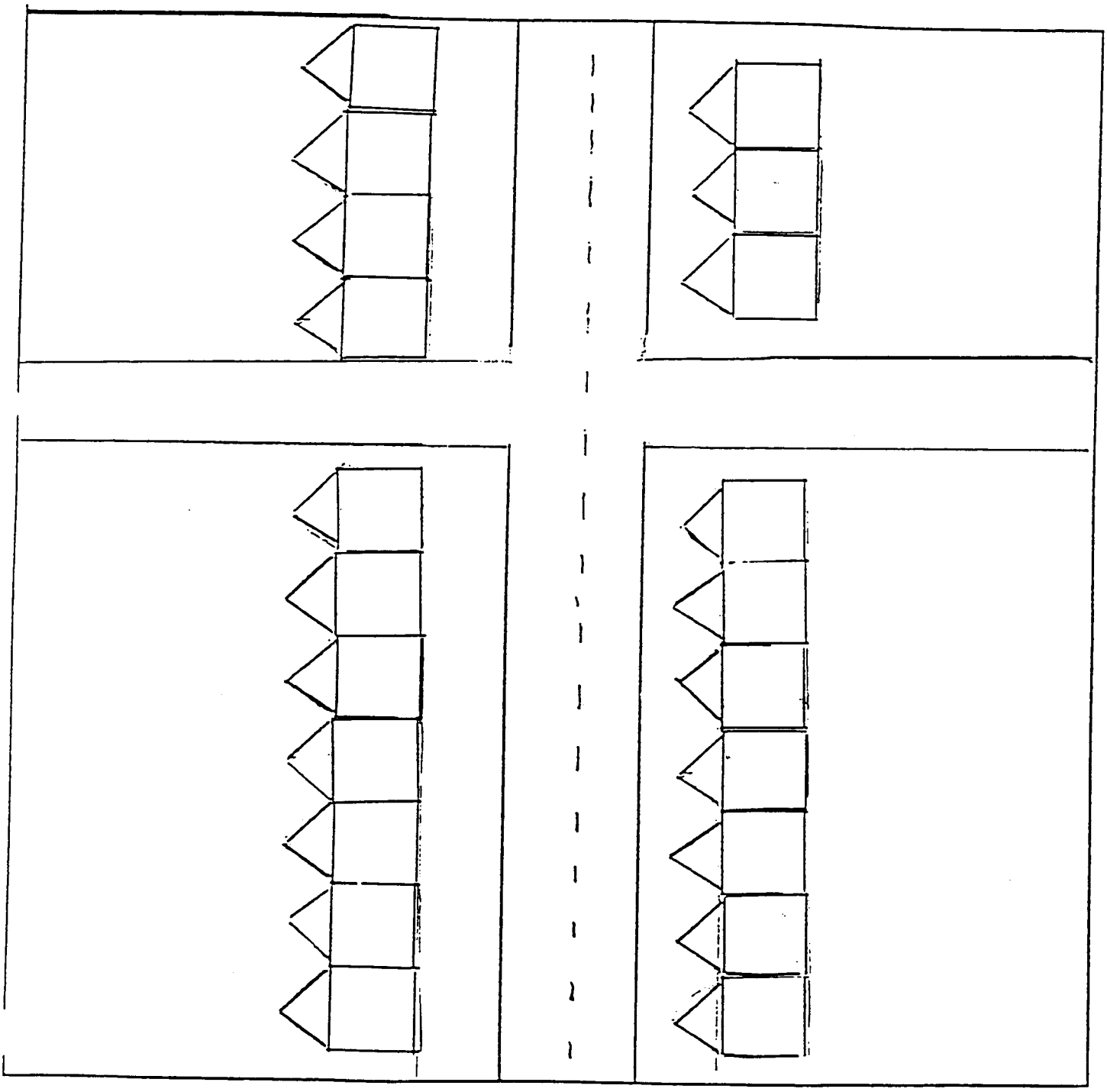
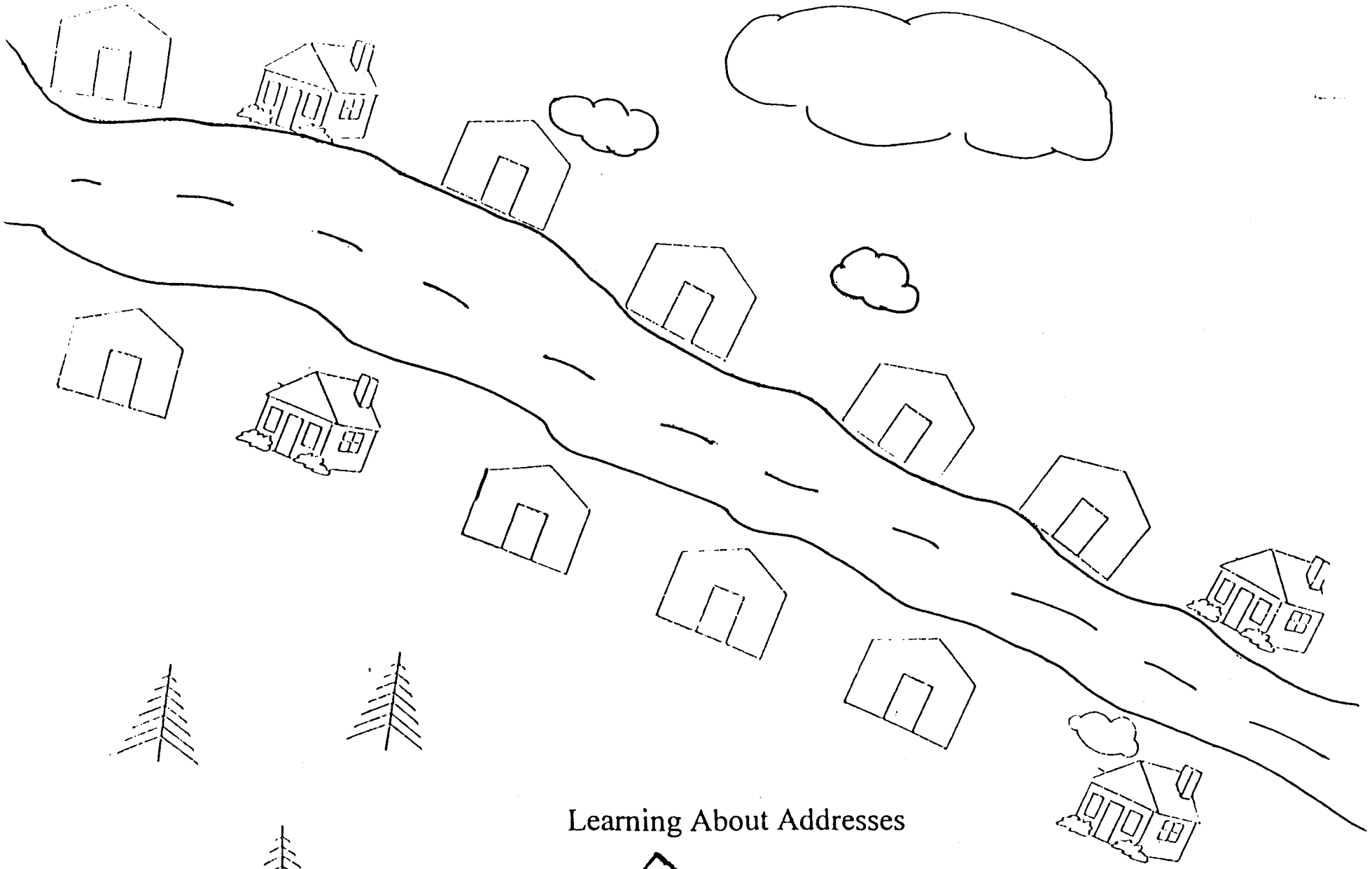
Learning About Addresses

A symbol stands for something. stands for a house. Each house needs an address. It is easy to learn how to get addresses for houses. One side of the street has___ numbers. The other side has ___ numbers. Addresses help us locate people and places.





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